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## The modified Peyton approach in the teaching of cardiac auscultation

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**Abstract:** **Background:** The aim of the study was to evaluate the usefulness of the modified Peyton's four-step approach in the teaching of cardiac auscultation and to determine students' perception of Peyton's four-step approach.

**Methods:** The opinion of the participants on the usefulness of the modified four-step approach was attained through the use of anonymous questionnaires, voluntarily completed by students, and on the basis of semi-structured interviews conducted with a subset of students.

187 second-year students of our 6-year long curriculum were enrolled. They attended an obligatory Laboratory Training of Clinical Skills course. The average group size was 16 students.

**Results:** The survey findings identified that 88.1% of participants found it helpful in developing their understanding of cardiac auscultation. 89.8% of all participants claimed that the new modified four-step approach facilitated memorization. The modified Peyton's four-step method allows for better organization of classes in the opinion of 87.6% students. The advantages of the method were noticed by the majority of students.

**Conclusions:** The modified Peyton's four-step approach in the teaching of cardiac auscultation under laboratory conditions was perceived by students to be a comprehensible method that facilitates understanding and memorization. This approach allows for improved organization of classes. From

the student's perspective this method allows one to master the technique of cardiac auscultation in the classroom, through the increased demand of the participants' attention, activity and involvement.

**Key words:** cardiac auscultation, the modified Peyton's four-step method, Educational Practices, Learning Strategies, Program Effectiveness.

## Background

One of the most important educational goals for students enrolled in medical studies around the world is to master the skills of history taking and conduction of the physical examination. Medical students can link this to improving patient care and safety. The program of classes at the Department of Medical Education of the Jagiellonian University Medical College is constantly being modified and improved to streamline the teaching process. Coordinators of particular subjects make every effort to make the classes more engaging for students, with the goals of having participants better understand the material presented and facilitate assimilation of said material. Coordinators try to ensure that the organization of classes meets students' expectations, that the didactic methods used in the classes are standardized across all student groups and are fully understood and accepted by them.

In the academic year 2017/2018, a modified Peyton approach (discussed in the text below) was used in the teaching of cardiac auscultation. Educating students on how to accurately perform cardiac auscultation is a difficult skill to master and teach. Heart auscultation is a vital skill for medical students, as such skills aid them in making accurate diagnoses in their future medical careers. The study's authors used the modified Peyton's method to teach auscultation of the heart, this has not been published so far.

Recent literature describes various modifications of Peyton's method. Originally, the Peyton's method was designed for a 1:1 teacher: student ratio [1–4].

The effects of the implementation of Peyton's four-step approach in the training of gastric-tube insertion using a manikin were described in 2011 in a randomized controlled trial.

It turned out that Peyton's four-step approach is superior to standard instruction "with respect to professionalism and accompanying doctor–patient communication and leads to faster performance when trainees perform the learned skill for the first time" [1].

The instructional approach was changed for use in small group teaching in 2014 and was described as a modified Peyton's method [4].

The Peyton method is a valuable didactic tool, especially in the conditions of medical simulation [4].

This method has been accepted by all students irrespective of nationality and gender.

The findings of this study claim that the modified Peyton's method is useful in the teaching of cardiac auscultation. This study will contribute to understanding how academic teachers can use this new method in the teaching of heart auscultation, and facilitate students' understanding and memorization of the material presented to them.

### **The aim of the study**

The evaluation of the usefulness of the modified Peyton's four-step approach in the teaching of cardiac auscultation in classes conducted in the form of bedside teaching under laboratory conditions.

In the study, usefulness of the modified Peyton's method could be defined using all of the following: instructional resources required for adoption of this method, integration into the curriculum, enhancement of student self-efficacy, instructional time, learning outcomes on OSCE (almost 100% of students passed the cardiac auscultation assessment following course completion).

### **Methods**

The study recruited second-year Polish students from the Faculty of Medicine of the Jagiellonian University Medical College and first and second-year foreign students from the School of Medicine in English participating in the Laboratory Training of Clinical Skills (LTCS) course. Classes were held in groups of approximately 16 people in appropriately-equipped rooms, enabling instruction under laboratory conditions, where the role of the patient is played by students. Each class lasted 90 minutes.

Students are taught to conduct a medical history and physical examination as part of the course. Teaching the physical examination is performed using a traditional method: first, the students watch a demonstrative video of the techniques involved, then the teacher who conducts the classes performs the examination techniques on one of the students before the group. All students then practice the examination on each other in pairs.

The modified Peyton's four-step approach was used to teach students how to perform cardiac auscultation. The students were not familiar with the approach prior to the classes.

## The first step of the modified Peyton's approach

In the first step, students watched the examination being performed by the teacher, without commentary, in real time.

Students were taught to auscultate the heart according to the following pattern:

- II intercostal space, on the right sternal border — aortic valve
- II intercostal space, on the left sternal border — pulmonary valve
- IV intercostal space, parasternal on the right side — tricuspid valve
- IV intercostal space, parasternal on the left side — Erb's point, the site where you can hear the tricuspid and mitral valve
- V intercostal space, in the left midclavicular line or more parasternally — the point can be verified by the placement of the examiner's hand, which allows one to feel the apical stroke — the site of auscultation of the mitral valve.

The students listened to the supine examinees using the diaphragm of the stethoscope. Then the subject was asked to lie down in the left lateral decubitus position, where they auscultated the mitral valve with the bell of the stethoscope (this position permits the auscultation of possible mitral stenosis, among other abnormalities). Then in a seated position, with the patient leaning forward, at maximal exhalation, the diaphragm is used again to auscultate intercostal spaces III and IV at the left border of the sternum and in the region of the aortic valve to hear, for example, possible aortic regurgitation.

## The second step

In the second step, the teacher conducting the classes repeated the examination at a slower pace, describing the location of every point of application of the stethoscope to the chest wall and naming the cardiac valve being auscultated, while also discussing additional maneuvers used in auscultation of the heart.

## The third step

In the third step, a volunteer from the students was asked to describe the examination as it was being carried out by the teacher.

## The fourth step

The student who commented previously on the auscultation of the heart in the third step was asked to independently perform the examination without any commentary in the fourth step. This student became an instructor for another group of 4 students. The student (the first instructor) then repeated the examination with commentary,

and in the third step another student commented on the examination by describing the maneuvers performed by the previous student. This way, four student-instructors were prepared, who conducted the subsequent portion of the lesson in groups of 4 people (or 3- or 5-people, depending on the size of the group). Each student practiced cardiac auscultation multiple times during the lesson and practiced using the modified Peyton's approach. They each commented on the examination being performed once, and then performed the examination themselves without commentary and then with commentary.

After the classes, students were asked to complete an anonymous questionnaire prepared by the author, in which they were asked to express their opinion on the modified Peyton's approach.

The original questionnaire was prepared in order to obtain opinions from students about the conducted classes. This tool was used for the first time in the study. There were no available tools in the literature that could be used in this study.

Completion of the questionnaire was voluntary. The questionnaire was composed of closed and open-ended questions. A partially structured interview was conducted with a group of 40 Polish and 38 foreigners. After the classes the teachers asked the students about their opinions about the teaching approach. Students' opinions obtained during the interview were found to correspond with the results of the questionnaire.

According to the authors, the most important outcome is the usefulness of the method in facilitating the understanding and memorization of newly-learned skills by students.

Data was entered into a Microsoft Excel spreadsheet, and then analyzed using IBM SPSS Statistics 25 and SAS Enterprise Guide 7.1.

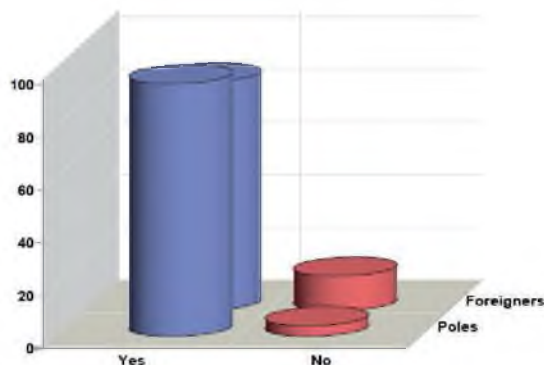
The Mann-Whitney U test was used to compare the age between groups and the Pearson chi-square test to investigate the relationship between two nominal variables. The significance level  $\alpha = 0.05$  was assumed. The study was approved by the Bioethical Commission of the Jagiellonian University Medical College.

## Results

224 Polish students and 106 foreigners used the modified Peyton's four-step approach in the training of cardiac auscultation. An anonymous survey was completed by 187 students, comprising of 149 Polish students (79.7%). Females constituted 55.6% of all respondents (57.7% for Poles and 47.4% for foreigners). Students were aged 19 to 28 years old, with an average of 21 years old. Foreign students were older (the average age of foreigners was  $22.1 \pm 2.6$  and of Poles was  $20.8 \pm 1.3$ ,  $p = 0.0253$  (using the Mann-Whitney U test, with continuity correction).

It was important to evaluate student's opinions about the new teaching approach before entering the curriculum.

To the question, “Do you think the way classes are conducted using the modified four-step approach is effective in teaching examination of the heart?” 94.1% of all students responded positively, 96% for Poles and 86.8% for foreigners ( $p = 0.033$  using Pearson’s chi-squared test) (Fig. 1).

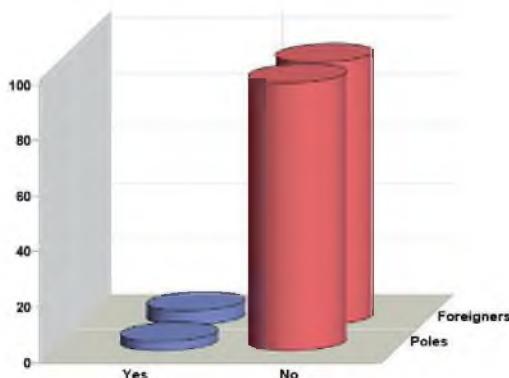


**Fig. 1.** “Do you think the way classes are conducted using the modified four-step approach is effective in teaching examination of the heart?”

The effectiveness of the method has been confirmed by the results of Objective Structured Clinical Examination (OSCE) following completion of the Laboratory Training of Clinical Skills course. Almost 100% of students passed the cardiac auscultation assessment on the OSCE.

According to the opinion of 81.7% of all participants of the classes, the new method was easily understandable.

96.3% of all students participating in the study believed that the modified Peyton method was not difficult, with 96.6% of Polish students thinking this way, along with 94.7% of foreigners ( $p = 0.58$  using Pearson’s chi-square test) (Fig. 2).



**Fig. 2.** “Do you think the four – step approach is difficult?”

71.4% of all students did not agree with the opinion that the traditional method used during the classes in the Department of Medical Education in the teaching of physical examination procedures was more beneficial than the modified Peyton's four-step approach.

When asked whether the classes (using the modified Peyton approach) were well organized, 87.6% of all participants of the classes responded positively, comprising of 86.5% of Poles and 91.9% of foreigners ( $p = 0.3$  in Pearson's chi-square test) (Fig. 3).

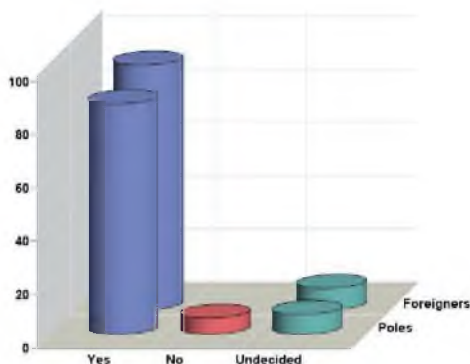


Fig. 3. "Were the lessons well – organized?"

88.1% of all students believed that the modified Peyton approach facilitated understanding of the topic of the classes, comprising of 89.9% of Poles and 81.1% of foreigners ( $p = 0.002$ , using Pearson's chi-square test) (Fig. 4).

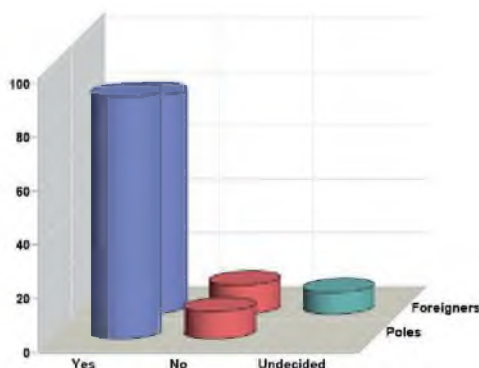


Fig. 4. "Did the four – step approach facilitate understanding?"

89.8% of all participants of the classes claimed that the new modified four-step approach facilitated memorization, which they explained was through multiple repetitions, along with necessitated attention and concentration.



According to the opinion of 83.3% of all students (86.5% of Poles and 71.1% of foreigners) the modified Peyton approach was easily implemented by students. When asked, "Which step was the most difficult?", participants' answers were as follows:

Step I for 15.5% of all students, Step II for 13.1%, Step III for 35.1%, and Step IV for 36.3%. This answer is justified by the fact that the fourth step required total independence of the student performing the examination.

Many of the students' opinions obtained during interviews overlapped with the results of the questionnaire; to quote some of them:

"The new method makes the class more interesting."

"Repetition helps with memorization."

"I feel that learning by repetition and observation of others may be useful in the case."

"I enjoyed the class and would like to also have make classes in the future conducted in this manner."

"Personally, I like it as it helps with my memorization and better understanding of the material."

"Unconventional teaching method. Makes class more interactive with active participation of all members."

"Continuous observation and repetition helps us to learn from each other's mistakes and also helps with easier memorize of the information continuous."

"I think that this is the best way to learn."

81.1% of both Polish and foreign students believed that the modified Peyton's four-step approach is useful in teaching examination of the heart.

## Discussion

Initial studies that describe Peyton's four-step approach report one teacher being responsible for one trainee [4]. The modification of this method consists of increasing the number of trainees per instructor [5–7]. This method has been used during all ESC (European Society of Cardiology) instructor courses since 2000 [8–11]. Classes in the Department of Medical Education of the Jagiellonian University Medical College are carried out in an environment that is practical and safe for students. Classes are safe because they are conducted under laboratory conditions, where the role of the patient is played by students [12, 13].

Quantitative analysis of the anonymous questionnaires of students who participated in the classes of cardiac auscultation indicated that the modified Peyton's approach is a valuable learning and teaching method. Learning the techniques of cardiac auscultation provided in four steps through observation and repetition, learning by teaching other students and active engagement facilitate comprehension and memorization. It is important to provide the opportunity for independent performance of the



entire examination under the supervision of a teacher conducting the classes. Each student participating in the classes, thanks to the modified Peyton method, practiced the examination multiple times under safe conditions, as a laboratory setting provides a protected, “mistake-forgiving” training environment [4]. According to students’ opinions, the classes in which the modified Peyton’s four-step approach were applied were well-organized, which is an important asset of the new teaching tool.

Students may feel supported and prepared using this approach. We believe, that this method will encourage engagement and promote deep learning.

The four-step method is recognized as a valuable and easy-to-use teaching tool in the literature of medical education [14]. Students who participated in our classes readily accepted this method. They perceived classes conducted utilizing the modified Peyton’s four-step approach as organized. The modified Peyton’s four-step method is intended for use in small groups; thus our classes were divided into smaller groups, in which they trained under the supervision of student-instructors.

Medical literature describes the use of the modified Peyton’s four-step approach in teaching difficult medical procedures [13, 15]. One example is the Nikendei study, in which he used this teaching method to demonstrate the insertion of an intravenous catheter to medical students in their first and second years of study [4]. The teachers and students participating in the study shared their personal experiences associated with the practical application of the four-step method in the teaching of the insertion of an intravenous catheter. They considered the modified Peyton’s four-step method to be useful and effective [4].

Following completion of the Laboratory Training of Clinical Skills course, almost 100% of students passed the cardiac auscultation station on the OSCE (Objective Structured Clinical Examination) — this is proof of the effectiveness of teaching using the modified Peyton’s method.

As confirmed in a study using the modified four-step method in teaching echocardiography using the FATE (Focus-Assessed Transthoracic Echo) protocol, this study also confirms that the modified four-step method leads to effective learning through observation, the tutor’s detailed instruction, multiple repetitions, and through teaching other students [4, 16].

According to the authors of this publication, it is worth conducting further research using the modified Peyton’s four-step approach to further define its usefulness as a didactic tool in teaching different aspects of the medical curriculum.

### **Limitations of the study**

The questionnaire was prepared by the authors and used for the first time in this study. A lack of any (even historical) control group. A small number of students participating in the study with only one skill being evaluated.

The evaluation of the approach is limited to student feedback, which is a significant limitation of this paper.

## Conclusions

The modified Peyton's four-step approach was positively perceived by students as a valid, new learning strategy. This new approach for teaching cardiac auscultation under laboratory conditions was perceived by students to be a comprehensible method that facilitates understanding and memorization. The modified Peyton's four-step approach allows for improved organization of classes that students appreciated, irrespective of nationality. From the student's perspective it is a method that allows one to master the technique of cardiac auscultation in the classroom, through necessitated intensification of the participants' attention, activity and involvement.

## Declarations

### Ethics

The study was approved by the Bioethical Commission of the Jagiellonian University Medical College.

### Consent for publication

Verbal consent was obtained from all participants. Questionnaires were anonymous. The ethics committee approved this procedure.

### Availability of data and material

A fully anonymous data set is available from the authors (agnieszka.skrzypek@gmail.com) on request.

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The study was approved by the Bioethical Commission of the Jagiellonian University Medical College.

## Authors' contributions

AS conceived the study, contributed to the design, data collection and paper preparation. PJ, MSz participated in the data collection and performed the statistical analysis. TG, DDD, MWG, GC participated in the data collection. IP, AS participated in the design and coordination. All authors of the study have read the manuscript and approved its contents.

## Acknowledgements

Not applicable.

## Conflict of interest

None declared.

## Abbreviations

LTCS — Laboratory Training of Clinical Skills  
FATE — Focus-Assessed Transthoracic Echo protocol  
OSCE — (Objective Structured Clinical Examination)

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